

ENGINEERING BULLETIN – FILTRATION SELECTION TABLE

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Product Range: All AOM products

The following document is a brief recap of the expected emissions from different types of commercial kitchen cooking as per Australian Standards AS1668.2-2012. The information provided is based upon a detailed international bibliography study on different type of cooking methods and equipment currently used in the industry, as well as an Australia Government funded AOM Australia / University of Sydney joint research project on commercial kitchen exhaust composition.

Commercial kitchen exhaust emissions are composed of the following main components:

- **Vapour and Grease Vapour:** grease vapour is the combination of grease particles and water vapour. Generally, water vapour will condense (generally within the exhaust ducting) and then liberate the contained grease particles. Smaller particles may then be exhausted, whilst larger particles will build up in the duct work.
- **Particle Matter (PM):** mainly composed of grease particles in different sizes, though solid fuel emissions also contain high concentrations of ash type particles. AOM Australia research has shown that emissions are mainly (>90%) composed (in concentration) of fine and ultra-fine particles (<PM2.5) which are significant contributors to urban air quality as well as a major health risk.
- **Volatile Organic Components:** which are highly volatile gas compounds which form the majority of the odour component of commercial kitchen exhaust. Depending on their structure, these can also have significant health implications.
- **Other gases** emitted from combustion processes (CO₂, CO, PAHs, etc).

The following table summarises the composition of different cooking types detailed in AS1668.2-2012.

Cooking Type	Description (AS1668.2-2012)	Total Grease (in all forms) and other PM emissions	Grease Vapour % (remaining is Grease PM %)	VOC content
Type 1	Non-grease producing equipment and void spaces under hoods	Very Low (prep area)	100% Vapour	Very Low to negligible
Type 2	Low-grease, medium heat producing equipment such as griddles, ranges, conventional fryers, gas ovens	Low (Ovens, Fryers) Medium (Griddle, Ranges)	80-90% Vapour (Ovens, Ranges) 60-70% Vapour (Fryers, Griddles)	Medium
Type 3	High grease, low heat producing equipment such as electric deep-fat fryers, grooved griddles, hot tops and hot top ranges	Low (Fryers) Medium (Griddles, hot tops)	60-70% Vapour (Fryers, Griddles)	Medium-High
Type 4 (light)	High grease, medium heat producing equipment such as countertop BBQs and gas fired deep fat fryers	Low - Medium (Fryers) High (Electric BBQ)	60-70% Vapour (Fryers, Griddles) 30-50% Vapour (BBQ)	High
Type 4 (heavy)	Same description as previous though AOM Australia describes heavy as the use of open gas flamed chargrills for meat cooking	Very High	30-40% Vapour	Very High
Type 5	High grease, high heat producing equipment such an open flame charcoal equipment utilising solid fuel	Very High	30-40% Vapour	Very High
Type 6	Oriental cooking tables and/or woks	High	50-60% Vapour	Very High - High
Type 7	Bread ovens and steam producing combination ovens.	Low	100% Vapour	Low

Based on the above table, AOM Australia proposes a Matrix for choice of Particle Matter filtration and Odour mitigation equipment. Three scenarios are considered:

1. **Do Nothing Scenario:** this scenario summarises the impact of the cooking emissions should it be chosen not to filter the cooking exhaust any more than a standard exhaust hood grease filter.
2. **Voluntary Treatment Scenario:** This scenario summarises the recommended treatment should a it be chosen to treat the commercial kitchen exhaust emissions, though the discharge is compliant to Australian Standards. The main objective of this is often to remove Particle Matter (visible smoke at discharge, build-up of grease in ducting)
3. **Compulsory Treatment Scenario:** This scenario summarises the recommended treatment for a non-compliant discharge point, requiring an Engineered Solution designed on the basis of a proven filtration performance to the AS1668.2-2012 Concession requirements.



Cooking Type	Do Nothing Minimal filtration – preliminary grease filter (honeycomb or baffle) at the hood level	Compliant Voluntary Treatment For particle matter filtration and / or minimising build-up of grease in ducting.	Non-Compliant Compulsory Treatment High efficiency particle filtration coupled with odour mitigation to independently tested odour removal efficiencies allowing for an AS1668.2-2012 concessions.
Type 1	No issue	No specific treatment	No specific treatment
Type 2	<ul style="list-style-type: none"> Build-up of grease in ducts Low concentrations of particle matter emissions Odour discharge that may cause a nuisance 	<ul style="list-style-type: none"> In hood UV treatment OR direct ozone injection In-hood or in-duct single pass electrostatic precipitator 	<ul style="list-style-type: none"> Single pass electrostatic precipitators (in hood or in duct) and odour control through ozone injection or activated carbon.
Type 3	<ul style="list-style-type: none"> Build-up of grease in ducts Low concentrations of particle matter emissions Odour discharge that may cause a nuisance 	<ul style="list-style-type: none"> In hood UV treatment OR direct ozone injection In-hood or in-duct single pass electrostatic precipitator 	<ul style="list-style-type: none"> Single pass electrostatic precipitators (in-hood or in-duct) and odour control through ozone injection or activated carbon
Type 4 (light)	<ul style="list-style-type: none"> Significant build-up of grease in ducts High concentrations of particle matter emissions Significant odour discharge that may cause a nuisance 	<ul style="list-style-type: none"> In-hood or in-duct single pass electrostatic precipitator 	<ul style="list-style-type: none"> Single or Double pass electrostatic precipitators (in-hood or in-duct) and odour control through ozone injection or activated carbon
Type 4 (heavy)	<ul style="list-style-type: none"> Significant build-up of grease in ducts Very high concentrations of particle matter emissions Significant odour discharge that may cause a nuisance 	<ul style="list-style-type: none"> Hood grease filter to be high efficiency UL listed In-hood or in-duct single or double pass electrostatic precipitator 	<ul style="list-style-type: none"> Double or Triple pass electrostatic precipitators (potential for single pass in hood and secondary filtration in duct) and odour control through ozone injection or activated carbon.
Type 5	<ul style="list-style-type: none"> Significant build-up of grease in ducts Very high concentrations of particle matter emissions Significant odour discharge that may cause a nuisance 	<ul style="list-style-type: none"> Hood grease filter to be high efficiency UL listed In-hood or in-duct single or double pass electrostatic precipitator In-hood or in-duct water misting system to mitigate sparks and embers 	<ul style="list-style-type: none"> Double or Triple pass electrostatic precipitators (potential for single pass in hood and secondary filtration in duct) and odour control through ozone injection or activated carbon. In-hood or in-duct water misting system to mitigate sparks and embers
Type 6	<ul style="list-style-type: none"> Significant build-up of grease in ducts High concentrations of particle matter emissions Significant odour discharge that may cause a nuisance 	<ul style="list-style-type: none"> In hood single pass electrostatic precipitator for high efficiency grease filtration 	<ul style="list-style-type: none"> Single or Double pass electrostatic precipitators (in-hood or in-duct) and odour control through ozone injection or activated carbon
Type 7	<ul style="list-style-type: none"> Little build-up of grease in ducts Very low concentrations of particle matter emissions Odour discharge that may cause a nuisance 	<ul style="list-style-type: none"> In hood UV treatment OR direct ozone injection 	<ul style="list-style-type: none"> Odour control through ozone injection or activated carbon

Notes to filtration efficiencies:

- The choice of **single/double** or **double/triple** pass electrostatic filtration depends upon the sensitivity of the discharge point.
- UV treatment:** current research shows that UV treatment has an insignificant impact of grease particle matter but that is may decrease grease vapour loads as well as breakdown VOC content (ozone). A similar outcome can be achieved with direct ozone injection into the exhaust hood using an ozone generator.
- Single pass in-hood or in-duct electrostatic precipitator:** proven to remove up to 98% of particle matter for the selected cooking types. See AOM Australia Performance Certification.
- Double pass in-hood or in-duct electrostatic precipitator:** proven to remove up to 98% of particle matter for selected cooking Types (Triple pass recommended in highly sensitive cases as a backup filter). See AOM Australia Performance Certification.
- Ozone injection and Activated Carbon:** proven to remove up to 90% of Volatile Organic Compounds (VOC) content allowing for significant odour mitigation fractional efficiencies. See AOM Australia Performance Certification.
- Misting systems:** AOM Australia recommends using a misting system for solid fuel to mitigate the risk of spark and embers entering the exhaust system. Ideally, the misting system is located after electrostatic precipitators have removed grease vapour and particle matter.

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